

Accounting for Epistemic and Aleatory Uncertainty in Early System Design, Phase I

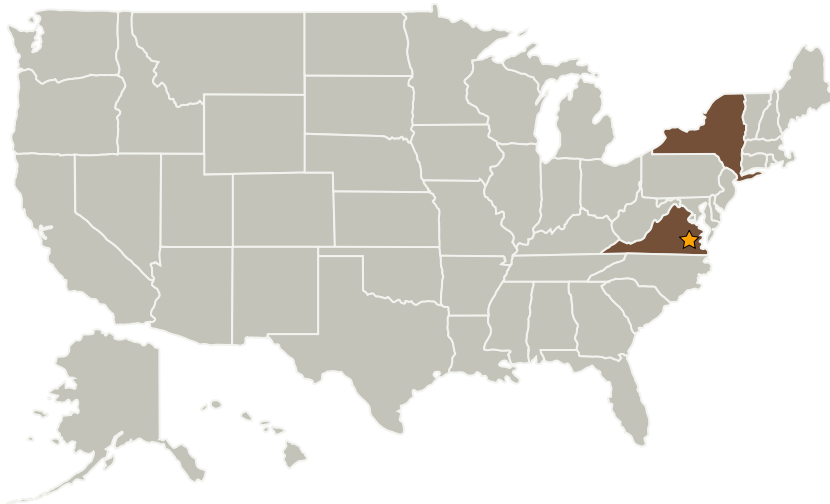
Completed Technology Project (2006 - 2006)



Project Introduction

The proposed work extends Probability Bounds Analysis to model epistemic and aleatory uncertainty during early design of engineered systems in an Integrated Concurrent Engineering environment. This method uses efficient analytic and semi-analytic calculations, is more rigorous than probabilistic Monte Carlo simulation, and provides comprehensive and (often) best possible bounds on mission-level risk as a function of uncertainty in each parameter. Phase I will demonstrate the capability to robustly model variability (aleatory uncertainty) and incertitude (epistemic uncertainty) during early design. The demonstrated methods will (1) allow rapid, rigorous, and more complete exploration of alternate designs in the mission- and engineering-constrained trade space; (2) provide a rigorous rationale for risk-based margin determination that is robust to surprise; (3) facilitate the incorporation of qualitatively described risks in quantitative risk analysis; (4) support the integration of physics and non-physics based risks in mission-wide risk analysis; and (5) permit sensitivity analysis at the mission, system, subsystem, and component levels that identifies the importance of specific uncertainties to uncertainty at higher levels and allows the rapid exploration of alternate strategies and designs. This suite of capabilities is not currently available to systems engineers and cannot be provided by more traditional probabilistic risk assessment methods.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Applied Biomathematics	Supporting Organization	Industry	Setauket, New York

Primary U.S. Work Locations

New York	Virginia
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Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
 - └ TX11.5 Mission Architecture, Systems Analysis and Concept Development
 - └ TX11.5.2 Tools and Methodologies for Performing Systems Analysis